TECHNICAL MEMORANDUM

AMBIENT AIR QUALITY SURVEY IN THE JUNCTION TRIANGLE AREA OF TORONTO FEBRUARY, 1986

ARB-74-86-AQ&M

March, 1986

Ontario Ministry of the Environment

Dr. David Balsillie, Director
Air Resources Branch

Technical Memorandum

Ambient Air Quality Survey in the Junction Triangle Area of Toronto February, 1986

ARB-74-86-AQ&M

Prepared for:

Central Region
Ontario Ministry of the Environment

Prepared by:

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March, 1986

Executive Summary:

From February 10 to 14 1986, Mobile Air Monitoring Unit #1 of the Air Resources Branch performed a 96-hour continuous ambient air monitoring survey in the Junction Triangle area of Toronto. This survey was requested by the Central Region. Using identical sampling methodology as was used during the May 1985 survey, the main aims were to compare the acquired results with the 1985 results and to assess/investigate any diurnal variations in the measured air contaminants.

With respect to the magnitude of the measured contaminants, all quantities were less than or similar to those measured during the May '85 survey and all quantities were less than the applicable environmental standards, guidelines or criteria. The concentrations of the common contaminants (i.e. SO_2, NO_x, CO, O_3, etc.) were similar to those reported in '85, whereas the specific hydrocarbon concentrations were normally 40 to 50% less. The average number of specific organics compounds detected during this survey was only 36 and the majority of these were the common alkanes - i.e. propane, butane, hexane, etc. (usually derivatives of fossil fuels - auto exhaust and home heating).

With respect to diurnal variations of these measured contaminants, the following observations were recorded: the largest concentrations were measured during the daytime (between 8 am and 4 pm); the smallest concentrations were measured between 4 and 7:30 am and between 4 and 6:30 pm; and finally, a slight increase was noted in the early evenings but gradually decreased after midnight till 7 am. The effects of the start-ups of the factories in the Junction Triangle and the on-set of the "rush-hour" traffic was also noted in the acquired data around 8 am and 4 pm but once again, all measured quantities were low and well below the applicable environmental standards, guidelines and criteria.

Introduction:

As a result of several reviews of the 1985 Technical Memorandum entitled "Ambient Air Quality Surveys in the Junction Triangle and Downtown Areas of Toronto, May 1985; ARB-099-85-AQM", an additional ambient air monitoring programme was requested for the Junction Triangle area by the Central Region of the Ministry of the Environment.

This monitoring programme was to commence as soon as possible and was to continue in at least 24 hour continuous monitoring segments until 96 hours of monitoring had been accomplished. Using the identical sampling methodology as was used during the '85 survey, the main aim of this survey was to investigate any possible diurnal variations of the monitored contaminants and to compare these results with the '85 results.

Since Mobile Air Monitoring Unit (MAMu) #2 was undergoing an extensive retrofit and since 24-hour day monitoring was requested (thus necessitating a significant commitment of manpower), only MAMu #1 was able to participate in this requested survey programme. MAMu #1 had not been retrofitted as of this time, thus the integrity of the sampling methodology would be preserved.

Three semi-permanent sites were utilized during this survey. They were located at: Pole #5 on Parkman Avenue (mid-way between Franklin and Perth Avenues), Pole #11 on Ernest Avenue (approximately 75 metres west of Perth Avenue) and Pole #25 on Antler Street (mid-way between Campbell Avenue and the CNR right-of-way).

This survey ran from February 10th to 14th inclusive and during these 5 days, 17.1 hours of continuously monitored ambient air data and 13 gas chromatographic (GC) samples were acquired at the Parkman site; 47.2 hours of ambient air data and 39 GC samples were acquired at the Ernest site; and 26.1 hours of ambient air data and 24 GC samples were acquired at the Antler site. The GC samples were discrete ambient air

samples that were acquired over 30-minute intervals - usually one sample every hour and the field gas chromatograph immediately analyzed (with the inherent capability of identifying and quantifying up to 125 different organics) each of these samples as soon as they were acquired. The common contaminants (such as CO, NO_x, SO_2, O_3, etc.) and meteorological parameters (such as temperature, wind speed and direction, barometric pressure, etc.) were measured on a continuous basis. As noted, 90 hours of continuous monitored data (out of a possible 96 hours) were acquired during this survey. Moving, calibrations and on-site maintenance accounted for these missing 6 hours.

Discussion of Results:

- Parkman Site; February 10 at 1300 hours to February 11 at 0800 hrs.

The general weather synopsis for this time was that a low pressure area was located near Sudbury and it was weakening and remaining nearly stationary. The weak cold front associated with this system had passed through Toronto and was now aligned north/south along the eastern edge of Lake Ontario. The air mass over Toronto was generally moist and unstable. Scattered to broken cumulus (strato and alto) clouds were present and the winds were northwesterly at about 10 km/hr initially and decreasing to a calm condition (i.e. less than 3 km/hr) overnight. No precipitation was present and the temperature was in the range of -4 to -12 °C (Celsius) with a dew point depression of approximately 5°C.

Mobile Air Monitoring Unit #1 (MAMu #1) arrived in the Junction Triangle area of Toronto at noon on Monday and after receiving the pertinent weather briefing and initial assessment of this area, it was set up in the monitoring mode at the Parkman site. The acquisition of continuously monitored ambient air data commenced at 13:13 hrs (reference to monitoring period (MP) A102) and the first GC sample was acquired between 13:29 and 13:59 hrs.

Thirteen GC samples and just over 17 hours of common contaminant data were acquired at this site. At 06:00 hrs on Tuesday morning, icing problems in the compressed air system of the MAMu forced termination of the sampling programme at this site.

As noted by the statistics of MP A102, no exceedances of any Environmental Standards, Guidelines or Criteria were measured for any of the common contaminants. For example, the overall arithmetic mean and maximum 60-minute average ground level concentrations (glc's) of CO (carbon monoxide) were 0.88 and 1.28 ppm (parts per million) respectively; of SO_2 (sulphur dioxide), they were 0.01 and 0.02 ppm respectively; and of O_3 (ozone), they were 0.01 and 0.02 ppm respectively. For the oxides of

nitrogen (NO_x) components (i.e. NO_2-nitrogen dioxide and NO-nitrogen monoxide), only NO concentrations were measured. The arithmetic mean and maximum 60-minute average glc's measured for this contaminant were 0.02 and 0.10 ppm respectively. Continuous measurements of total hydrocarbon (THC), non-methane hydrocarbons (TH-M) and methane (CH_4) concentrations were also carried out during this survey. These measurements served only as a general quantitative backup for the GC measurements of hydrocarbons. Nevertheless, the overall arithmetic mean and maximum 60-minute average glc's of TH-M were 0.99 and 2.33 ppm respectively (since these are general, non-specific measurements of hydrocarbons, no Standards, Criteria nor Guidelines exist for these parameters) - see Figure #1.

As noted from the time/concentration graph of the common contaminants as measured during this monitoring period, the concentrations increased as the winds decreased and in particular, from the wind rose/concentration frequency analysis for TH-M, the majority of the TH-M concentrations appear to have originated from the west to the northwest sector with respect to this Parkman site. The most prominant source in this sector being Viceroy Rubber and Plastics - see Figure #10.

From the analyses of the 13 GC samples acquired at this site, the total hydrocarbon loadings ranged from 97 to 323 ug/m^3 (micrograms per cubic metre) with an average concentration of 209 ug/m^3. On the average, the alkane fraction comprised 49% (102 ug/m^3) of these total hydrocarbon loadings; the alkenes 1% (3 ug/m^3); the aromatics 41% (85 ug/m^3); and the chlorinated organics 2% (5 ug/m^3). For the estimated 35 plus identified specific hydrocarbons determined from each of these samples, all individual concentrations were found to be well below the applicable Environmental Standards, Criterion or Guidelines. For the common alkanes (i.e. propane, butane, pentane and hexane), the mean loadings were in the range of 5 to 20 ug/m^3. The most prominant alkane was 2-methylbutane and its average loading was 21 ug/m^3. For the BTX's (i.e. benzene, toluene and xylenes), the average loadings ranged from 6 to 42 ug/m^3 - see Table #3.

As mentioned earlier, the continuous monitoring of TH-M was used as a quantitative backup for the GC sampling programme. The agreement between these two sets of measurements was very good and can be readilv seen upon comparing the time/concentration graphs for the common contaminants and the concurrent GC data (Figures 1 and 5).

- Ernest Site: Feburuary 11 at 1000 hrs to February 13 at 1030 hrs.

Four monitoring periods encompassed this time period during which 46.7 hours of continuous ambient air data were acquired for the common contaminants and 39 GC samples were acquired for specific hydrocarbon analyses.

The aforementioned weak low pressure system had slowly pushed into Quebec and the Eastern Townships. Initially the winds were northwesterly and light but backed throughout this period and became southwesterly early Thursday morning. The air mass was dry and stable, however by early Thursday morning, some moisture had pushed into the Toronto area from the southwest. Mainly scattered cumulus clouds prevailed and by late Wednesday or early Thursday morning, some light snow flurries were present. The temperature ranged from -5 to -15°C and the dew point depression was approximately 5°C.

The continuous monitored data for the common contaminants as acquired during these 4 monitoring periods was merged into one data set (noted as E001) for statistical interpretation. As can be seen from this merged data set, no exceedances of the applicable Environmental Regulations were recorded. For example, the overall arithmetic mean and maximum 60-minute average concentrations of CO were 0.70 and 2.70 ppm respectively; of SO_2, 0.02 and 0.07 ppm; of NO_X, 0.06 and 0.24 ppm; and of O_3, 0.02 and 0.04 ppm respectively - see Figure #2.

A small but noticable increase in concentration levels of SO_2 were recorded at this Ernest Street site as compared to the results obtained at the Parkman site. For the Ernest site, the maximum 1-minute average SO_2 concentration was 0.14 ppm and from the wind rose/concentration frequency analyses of this data, the most dominant source area of this pollutant was to the west of this site. Hence, this data inferred that the most probable source of SO_2 would be ITT Grinell - see Figure #12.

From the analyses of the 39 GC samples acquired at this site, the total hydrocarbon loadings ranged from 49 to 117 ug/m^3 with an average loading of 193 ug/m^3. On the average, the alkane fraction comprised 51% (99 ug/m^3) of these loadings, the aromatic 29% (56 ug/m^3), the

alkenes 0.5% (1 ug/m ^{3}) and the chlorinated organics 1% (2 ug/m^{3}). Again, the loadings of the individual hydrocarbons detected in these samples were low and did not approach any applicable Environmental Guideline, Standard or Criterion concentration level. For the common alkanes, the average loadings ranged from 7 to 34 ug/m^{3} and for the BTX's, the average loadings ranged from 8 to 28 ug/m^{3}. Finally, the most prominant organic detected in the samples was 2-methylpropane and its average loading was only 54 ug/m^{3} - see Table #4.

Again, the non-methane hydrocarbon measurements dictated the relative quantitative loadings anticipated/acquired for the GC samples. As determined from the merged data set, the overall arithmetic mean TH-M concentration was 0.79 ppm and its maximum 60-minute average concentration was 4.87 ppm.

- Antler Site; February 13 at 1100 hrs to February 14 at 1300 hrs.

One monitoring period (A132) encompassed this time period during which 26.1 hours of continuously monitored ambient air data were acquired for the common contaminants and 24 GC samples were acquired for specific hydrocarbon analyses.

Another weak low pressure area was pushing into northern Ontario and from this low, a NE/SW trough was positioned through Lake Michigan during the early morning of February 14th. West backing to southwest winds prevailed with the intensity increasing as time evolved (up to 30 km/hr). Because moisture was still being pushed into the Toronto area from the southwest, the air mass became more moist and unstable. Broken to overcast conditions prevailed and by noon on Friday, light snow had developed. The temperature still ranged between -5 and -10°C and the dew point depression was approximately 5°C.

Once again for the common contaminants, all measured concentrations were below any of the applicable Environmental Standards, Criterion or Standards.

For this monitoring period, the overall average and maximum 60-minute average concentrations of CO were 0.61 and 1.34 ppm respectively; of SO_2, 0.02 and 0.14 ppm respectively; of NO_x, 0.05 and 0.13 ppm; and of O_3, 0.05 and 0.06 ppm. During Friday morning, a significant increase in SO_2 concentrations was recorded. The maximum 60-minute SO_2 concentration was recorded at this time and the maximum 1-minute average concentration was 0.180 ppm. From the wind rose analyses, the source originated southwest of this site - the Nacan, Glidden and ITT Grinell complexes. Also, at this time, there were significant increases in CO and NO_x concentrations and these essentially duplicated the SO_2 time/concentration response curve - see Figures #3 and #13.

From the analyses of the 24 GC samples acquired at this site, the loadings were similar to those reported for the other two sites. The total hydrocarbon loadings ranged from 51 to 388 ug/m^3 (a mean of 120 ug/m^3) and on the average, the alkanes comprised 52% (62 ug/m^3) of these loadings; the alkenes 1% (1 ug/m^3); the aromatics 34% (41 ug/m^3); and the chlorinated organics 2% (2 ug/m^3). For the common alkanes, the loadings ranged from 8 to 15 ug/m^3 and for the BTX's, the loadings ranged from 5 to 13 ug/m3 - see Table #5.

Conclusions:

During the 96 hours of on-site monitoring in the Junction Triangle, 90 hours of continuous data for the common contaminants and 76 gas chromatographic samples for specific hydrocarbon analyses were acquired. The ambient temperature was very cold (often less than -10°C); the cloud cover was scattered to broken; and the winds were northwest backing to southwest at speeds usually less than 15 km/hr.

For the common contaminants such as CO, SO_2, NO_x and O_3 and as expressed in a merged data set encompassing this entire survey period, all concentrations were found to be less than any of the applicable Environmental Regulations and similar to those reported for the '85 survey. For CO, the overall mean ground level concentration (glc) determined from this survey was 0.71 ppm whereas for the '85 survey, the glc value was 1.85 ppm. For SO_2, the overall mean glc was 0.02 ppm, whereas in '85, this glc value was 0.01 ppm. For NO_x, the overall mean glc was 0.06 ppm and in '85, the overall mean glc was 0.04 ppm. Identical glc's of O_3 were reported for both of these surveys - 0.02 ppm.

The slight increase in SO_2 is due to the fact that during this '86 survey, the monitoring unit was positioned for a considerable amount of time downwind of ITT Grinell - see Figures #4 and #12. Further to source delineation work, significant SO_2 concentrations were measured at times when there was no apparent increase in the non-methane hydrocarbon concentrations. Correlation statistics between these two parameters validated this observation. For 50 degrees of freedom, no correlation was found to exist between SO_2 and TH-M (the coefficient was only 0.009). Thus this suspected major source of SO_2 in the Junction (i.e. ITT Grinell) was deemed not to be a major source of organics in this area - see Table #6 and Figure #14.

As the wind speed increased, the concentrations of organics and other contaminants were expected to decrease. The correlation statistics between TH-M and wind speed highlights this point and also shows that the majority of the sampling took place when the wind speed was less than or equal to 16 km/hr (10 miles/hr) - a monitoring condition explicitly

stated at the onset of this survey. The correlation coefficient was determined to be -0.324 and this is considered to be highly significant at the 99% confidence level with 88 degrees of freedom - see Figure #15.

Three salient features were noted in the time/concentration graph of this merged data set of the common contaminants and these may be considered as being diurnal features for this area (see Figure #4). The first; due to calmer winds and colder temperatures, a general decrease (subsidence) of measured concentrations was noted between 11 pm and 5 am. The second; due to increased early morning traffic in the area, calm winds and the daily start-up of the plants/factories in the Junction, an abrupt increase in the measured concentrations was noted between 6 am and 9 am. The third; due to increased temperatures (albeit still very cold) and increased wind speeds, the most variability in the measured concentrations was noted in the afternoons up until 7 pm.

For the GC sampling program, the average total hydrocarbon loadings determined at all three sites were similar (ranging from 120 to 209 ug/m^3 with an overall mean loading of 173 ug/m^3). From 50 GC samples acquired during the '85 survey, the average total hydrocarbon loading was 308 ug/m^3. In 1986, on the average, the alkane fraction comprised 51% (88 ug/m^2) of the total hydrocarbon loadings, in '85 they comprised 45% (139 ug/m^3). Similarly, in '86, the aromatic fraction comprised 32% (56 ug/m^3) of the total hydrocarbon loadings whereas in '85, this percentage was 40% (124 ug/m^3). Or in other words, during the winter of '86, the average total hydrocarbon loadings were 44% less than those reported during the'85 summer survey, the alkanes 37% less and the aromatics 55% less.

The success of identifying all the organics compounds depicted by the chromatograms is reflected by the area percent identified peak figures. From the analyses during the '85 survey, these figures ranged between 70 and 80%; for this survey, this mean percentage figure was 79%. Although the GC library/software system has the potential of identifying and quantifying up to 125 different organics compounds, the average number of organic compounds detected in the acquired 76 GC samples during this survey was only 36 (the maximum number was 53).

For the individual hydrocarbons, the reported loadings did not approach or exceed any of the applicable Environmental Guidelines, Criterion or Standards. Essentially, all concentrations were considered to be at or near background levels.

A plot of these hydrocarbon loadings versus acquired time revealed some interesting diurnal variations - see Figures #6 through #9.

- The alkane concentrations remained essentially uniform throughout the day (Figure #8).

- The aromatic concentrations were at or near background levels between 4 and 7:30 am and between 4 and 6:30 pm (Figure #7).

- The aromatic concentrations were at their largest and depicted the greatest variance between 8 am and 4 pm (Figure #7).

- Although significant variations in the aromatic loadings were also noted for the evening samples, the maximum loadings were less than those reported during the day and after midnight, a gradual decrease in these concentrations became more evident as the morning approached (Figure #7).

- The average alkane loadings was 88 ug/m^3 and the average aromatic loading was 56 ug/m^3.

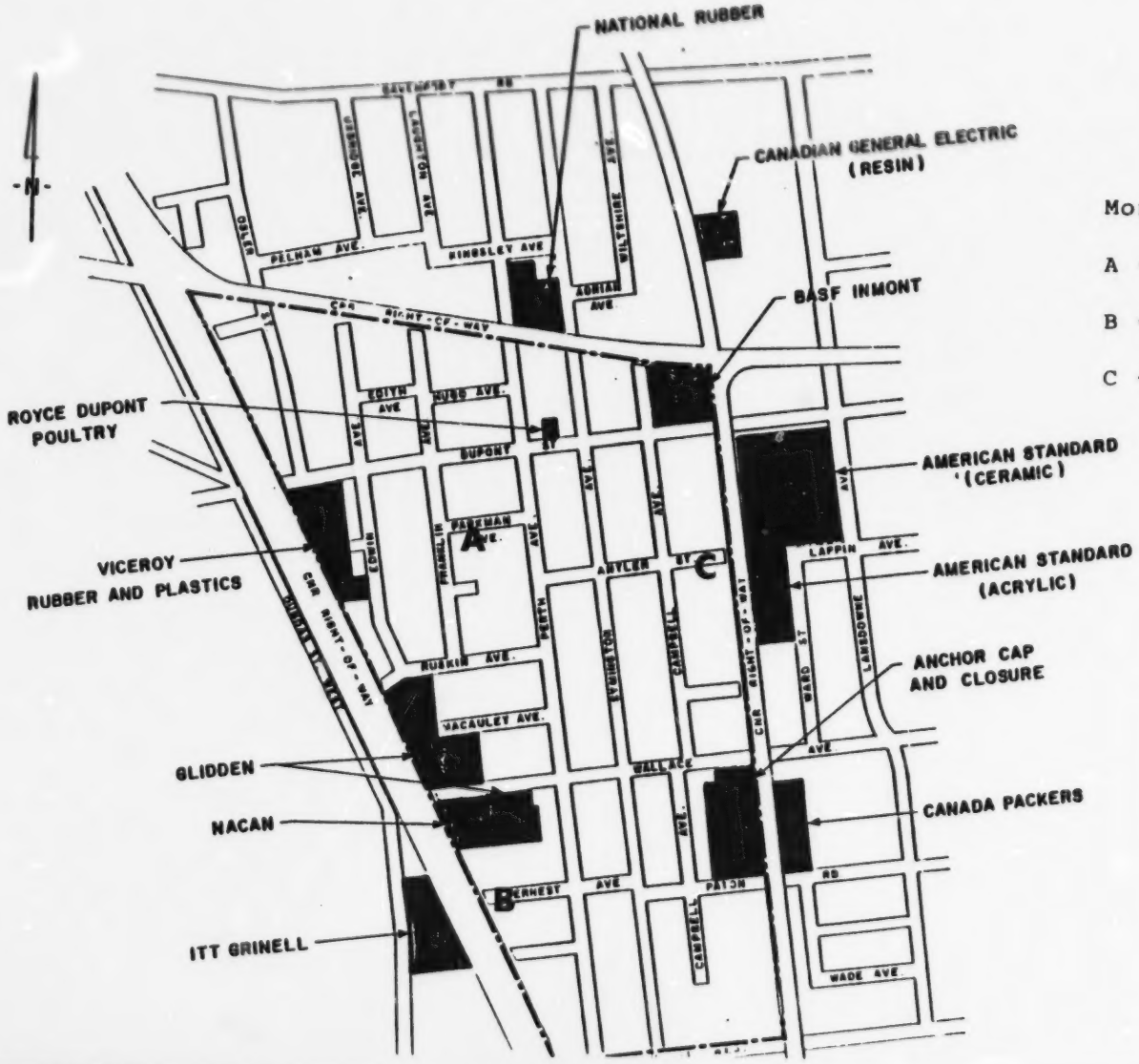
- For the total hydrocarbon loadings, essentially all values were less than 400 ug/m^3 (a mean of 173 $ug/3$) and any variation was due mainly to the alkane fraction - especially at 8 am and 1,3 and 4 pm which could be directly attributed to vehicular traffic (Figure #6).

The correlation statistics for the entire merged data set of the common contaminants (see Table #6) and the loading ratios of toluene, benzene and xylenes to ethylbenzene as determined from the 76 GC samples (see Tables #3, 4 and 5) give some insight as to the character of the pollutant sources monitored in the Junction Triangle at this time. The overall averaged ratios of toluene, benzene and xylenes to ethylbenzene were 6.7, 1.9, 4.1 to 1 and this suggested a predominant evaporative/combustion type source(s); noteably the internal combustion machine and fossil fuelled furnaces. This hypothesis is also supported by the highly significant positive correlations between CO, TH-M (noted as Non-CH_4) and NO_X and negative correlations between CO, NO_X and O_3. Thus in winter and as anticipated, the predominant source(s) of contaminants in the Junction could be attributed to vehicular exhaust and home heating effects. The home heating effects dominating in the evening (as noted by the relative large variations of the alkane loadings shown in Figure #6) and the vehicular exhaust dominating during the rush hour periods.

RB/6SM1-30

Junction Triangle Area of Toronto

Area Map and Monitoring Sites



Monitoring Sites

A - Parkman Site

B - Ernest Site

C - Antler Site

TABLE #1

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```
Name: JUN_TRI_86:A102                          Source:     4 MAMU-1
Date: 86/02/10 13:13:00  Scan:    60 sec  #Scans:   1026.  Dur:    17.10 hr
Loc : Pole #5 on Parkman Avenue (north side of park)
Pols: CO   THC  SO2  TH-M CH4  NOx  NO2  NO   O3   SRAD TEMP BAR  W.SP W.DI


Name: JUN_TRI_86:A112                          Source:     4 MAMU-1
Date: 86/02/11 10:10:00  Scan:    60 sec  #Scans:    572.  Dur:     9.53 hr
Loc : Pole #11 on Ernest Avenue.....just west of Perth Avenue
Pols: CO   THC  SO2  TH-M CH4  NOx  NO2  NO   O3   SRAD TEMP BAR  W.SP W.DI


Name: JUN_TRI_86:A113                          Source:     4 MAMU-1
Date: 86/02/11 19:45:00  Scan:    60 sec  #Scans:    759.  Dur:    12.65 hr
Loc : Pole #11 on Ernest Avenue....just west of Perth Avenue
Pols: CO   THC  SO2  TH-M CH4  NOx  NO2  NO   O3   SRAD TEMP BAR  W.SP W.DI


Name: JUN_TRI_86:A122                          Source:     4 MAMU-1
Date: 86/02/12 09:10:00  Scan:    60 sec  #Scans:    912.  Dur:    15.20 hr
Loc : Pole #11 on Ernest Avenue...just west of Perth Avenue
Pols: CO   THC  SO2  TH-M CH4  NOx  NO2  NO   O3   SRAD TEMP HUM  BAR  W.SP
      W.DI

Name: JUN_TRI_86:A131                          Source:     4 MAMU-1
Date: 86/02/13 00:31:00  Scan:    60 sec  #Scans:    561.  Dur:     9.35 hr
Loc : Pole #11 on Ernest Avenue...just west of Perth Avenue
Pols: CO   THC  SO2  TH-M CH4  NOx  NO2  NO   O3   SRAD TEMP BAR  W.SP W.DI


Name: JUN_TRI_86:A132                          Source:     4 MAMU-1
Date: 86/02/13 11:07:00  Scan:    60 sec  #Scans:   1566.  Dur:    26.10 hr
Loc : Pole #25 on Antler Street...at east end by railway tracks
Pols: CO   THC  SO2  TH-M CH4  NOx  NO2  NO   O3   SRAD TEMP HUM  BAR  W.SP
      W.DI

Name: JUN_TRI_86:E001                          Source:     4 MAMU-1
Date: 86/02/11 10:10:00  Scan:    60 sec  #Scans:   2862.  Dur:    47.70 hr
Loc : Merging of all data acquired on Ernest Avenue..just west of Perth
Pols: CO   THC  SO2  TH-M CH4  NOx  NO2  NO   O3   SRAD TEMP BAR  W.SP W.DI


Name: JUN_TRI_86:M001                          Source:     54 Link-MAMU-1
Date: 86/02/10 13:13:00  Scan:    60 sec  #Scans:   5760.  Dur:    96.00 hr
Loc : Merging of all data collected in Junction Triangle..02/86
Pols: CO   THC  SO2  TH-M CH4  NOx  NO2  NO   O3   SRAD TEMP BAR  W.SP W.DI
```

TABLE #2

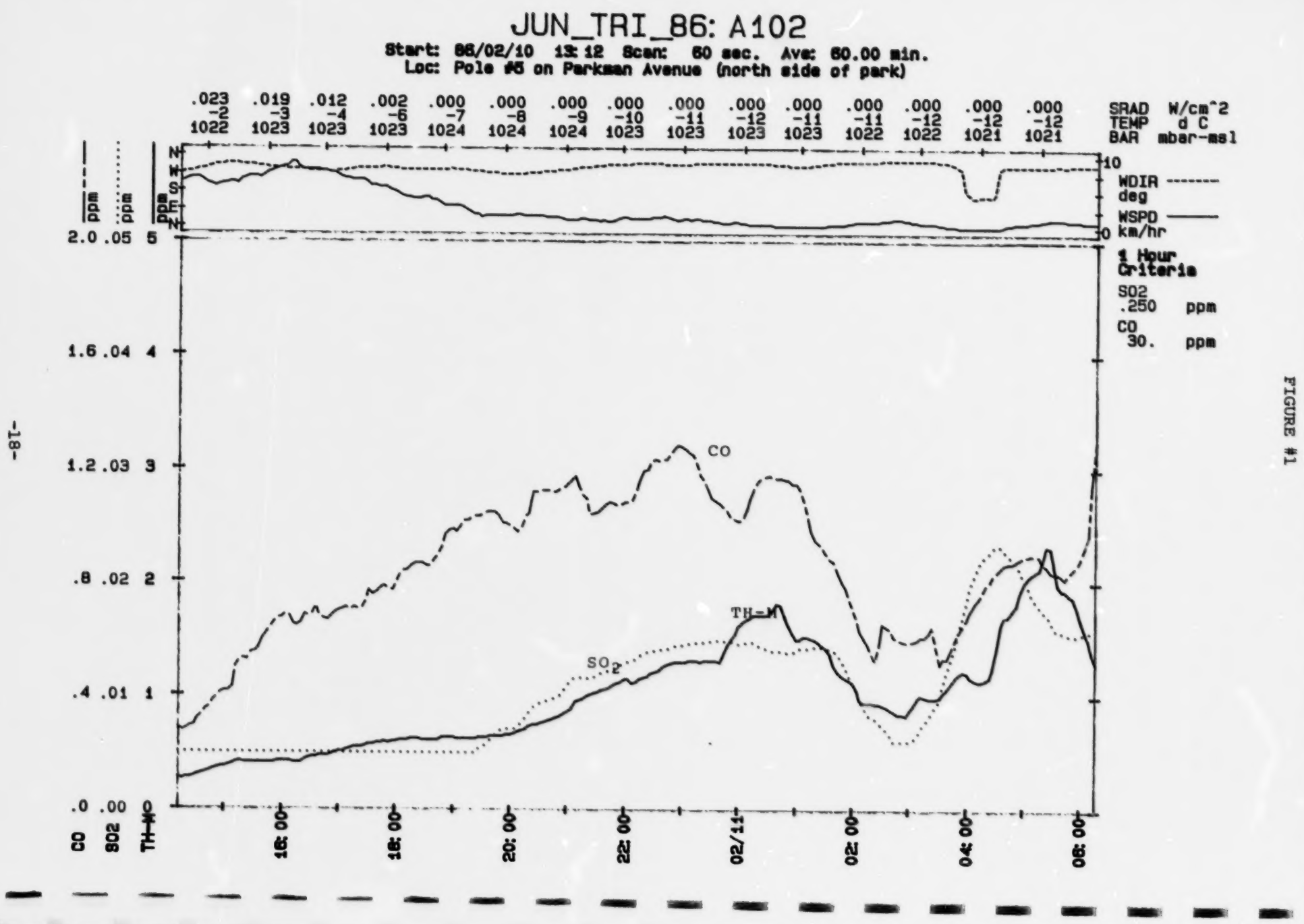
THE INSTRUMENTATION OF MOBILE AIR MONITORING UNIT #1

Instrument	Manufacturer	Analytical Technique	Full Scale Sensitivity
THC, CH4, TH-M analyzer	Ingenieur-Produktions-Gruppe Munchen (IPM) RS-t	Dual flame ionization	50 ppm THC (as CH4)
H2S,SO2,NOx sources	Hartmann & Braun Prufgasgenerator	N/A	N/A
TRS/SO2 analyzer	Monitor Labs 8850 c/w ML 8770	Fluorescence	1.0 ppm SO2 0.5 ppm TRS
NOx, NO2, NO analyzer	Monitor Labs 8840	Chemi-Luminescence	1.0 ppm NOx (as NO2)
CO analyzer	Thermo Electron P48	Gas Filter Correlation	100 ppm CO
O3 analyzer/ source	Dasibi 1003-AAS	UV Absorption	1.0 ppm O3
CO & THC sources	Matheson	Compressed Gas	N/A
Gas Chromatograph	HP 5880 Dual Capillary Column	Flame Ionization Det.	as set per calibrations

Meteorological Instrumentation

Instrument	Manufacturer	Scale
** Wind speed	Lambrecht GmBH	km/hr
** Wind direction	Lambrecht GmBH	degrees
Temperature	Weather Measure (WM) T621	degrees Celsius
Humidity	WM-HM-11P	absolute & %
Barometric pressure	WM-BM70-B242	millibars
Solar Radiation	WM Star Pyranometer	milliwatts/cm2

** These instruments are located on top of a 10 metre retractable tower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-2 -3 -4 -6 -7 -8 -9 -10 -11 -12 -11 -11 -12 -12 -12
1022 1023 1023 1023 1024 1024 1024 1023 1023 1023 1023 1022 1022 1021 1021
SRAD W/cm^2
TEMP d C
BAR mbar-msl
WDIR deg
WSPD km/hr
1 Hour Criteria
SO2 .250 ppm
CO 30. ppm
CO
SO2
TH-M
2.0 .05 5
1.6 .04 4
1.2 .03 3
.8 .02 2
.4 .01 1
.0 .00 0
18:00
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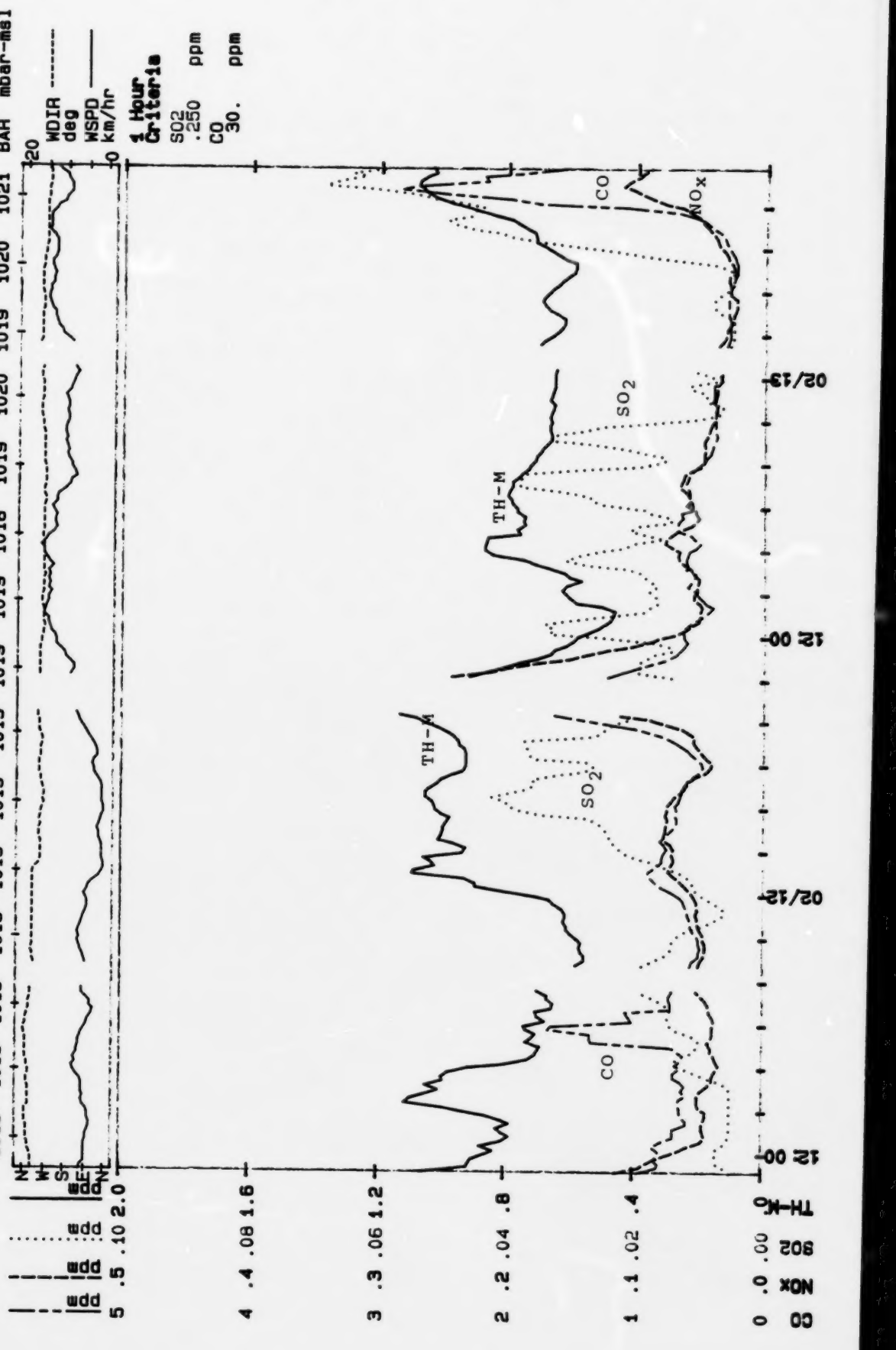
20:00
22:00
02/11
02:00
04:00
06:00

FIGURE #1

FIGURE #2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TEMP d C
BAR mbar-msl
WDIR deg
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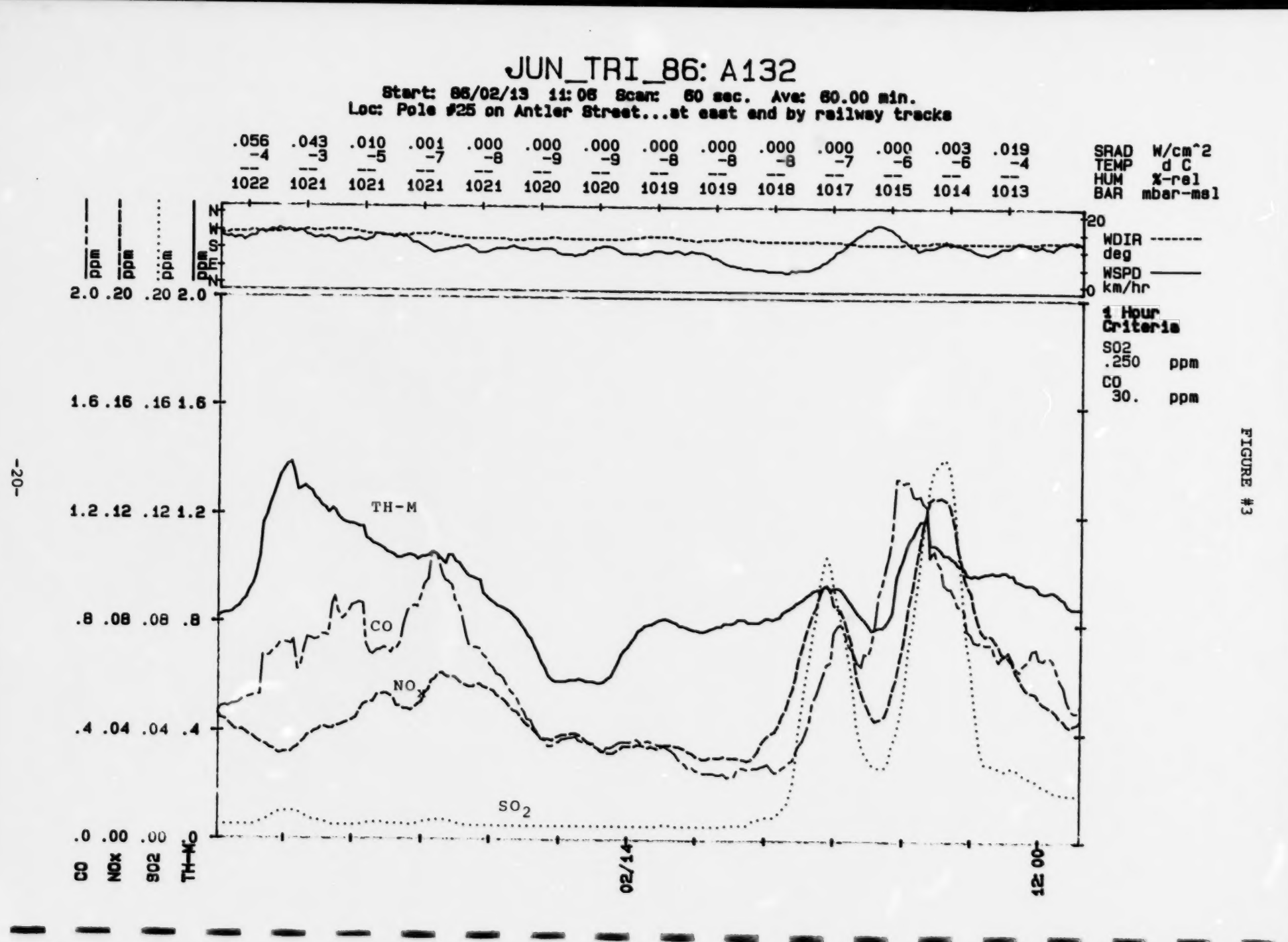
TH-M
02/12
12 00
CO NOx SO2 TH-M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-4 -3 -5 -7 -8 -9 -9 -8 -8 -8 -7 -6 -6 -4
1022 1021 1021 1021 1021 1020 1020 1019 1019 1018 1017 1015 1014 1013
SRAD W/cm^2
TEMP d C
HUM %-rel
BAR mbar-msl
WDIR deg
WSPD km/hr
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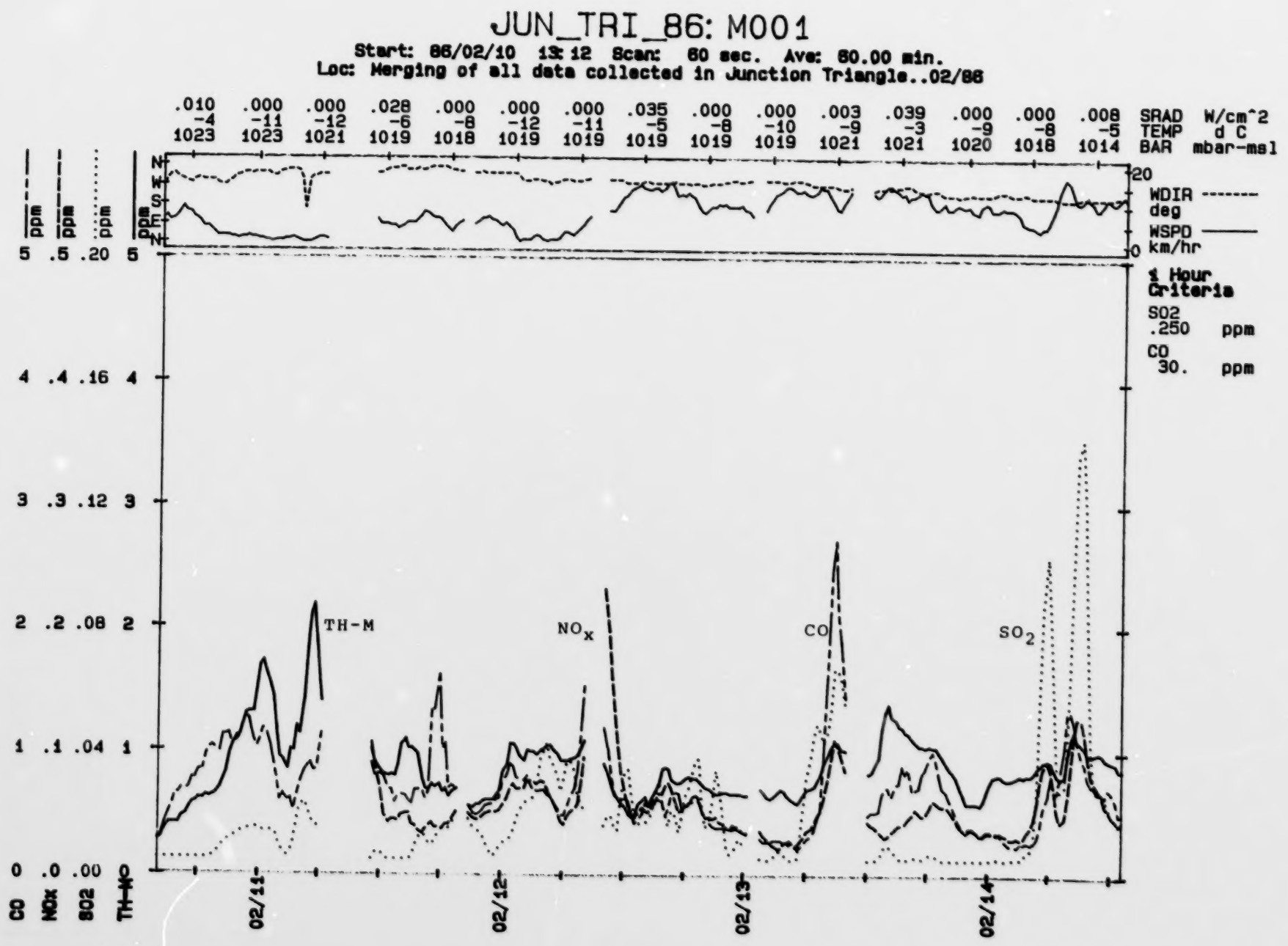
SO2
02/14
12 00
CO NOx SO2 TH-M

FIGURE #3


JUN_TRI_86: M001
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Loc: Merging of all data collected in Junction Triangle..02/88
.010 .000 .000 .028 .000 .000 .000 .035 .000 .000 .003 .039 .000 .000 .008 SRAD W/cm^2
-4 -11 -12 -6 -8 -12 -11 -5 -8 -10 -9 -3 -9 -8 -5 TEMP d C
1023 1023 1021 1019 1018 1019 1019 1019 1019 1019 1021 1021 1020 1018 1014 BAR mbar-msl
N W S E N
20
0
WDIR deg
WSPD km/hr
1 Hour Criteria
SO2 .250 ppm
CO 30. ppm
ppm ppm ppm ppm
5 .5 .20 5
4 .4 .16 4
3 .3 .12 3
2 .2 .08 2
1 .1 .04 1
0 .0 .00
CO NOx SO2 TH-HC
TH-M
NOx
CO
SO2
02/11
02/12
02/13
02/14

FIGURE #4

JUNCTION TRIANGLE GAS CHROMATOGRAPHIC DATA.....FEB/86

ACQUIRED AT THE PARKMAN SITE

SAMPLE I. D.	SAMPLE ENDTIME	AREA 1 IND PEAKS	THC	ALKANES	CYCLO-ALKANES	ALKENES	CYCLO-ALKENES	ALKYNES	AROMATICS	CHLORO ALKANES	CHLORO ALKENES	CHLORO AROMATICS	PROPANE	2-METHYL PROPANE	BUTANE	2-METHYL-BUTANE	PENTANE	TOLUENE: E-BENZENE	BENZENE E-BENZENE	XYLENES E-BENZENE
A102	1359	86	97	59	6	2	1	0	25	0	1	0	2	4	11	10	6	5	3	4
A102	1459	90	136	56	3	2	0	0	60	1	1	2	11	5	11	10	6	7	1	4
A102	1600	89	123	69	5	1	1	0	41	1	2	1	3	5	15	15	8	7	2	4
A102	1839	88	164	97	7	1	1	0	51	1	2	1	5	7	21	21	12	6	2	5
A102	1931	85	186	98	11	3	1	0	53	1	2	1	17	6	19	20	12	5	2	4
A102	2038	86	154	75	9	1	1	0	63	1	2	1		1	7	13	9	5	2	4
A102	2133	78	252	131	12	3	1	0	97	1	3	2	2	7	20	30	20	9	2	5
A102	2232	69	231	80	11	2	1	0	135	1	0	2			6	16	11	12	1	4
A102	2332	67	254	91	14	4	2	0	140	0	0	1	1	3	11	16	9	23	2	5
A102	31	84	323	143	9	3	1	0	159	0	0	2	7	8	34	28	15	18	1	5
A102	137	60	206	117	12	3	1	0	133	5	1	12	3	5	16	17	10	14	1	5
A102	242	92	296	204	7	3	1	0	63	1	0	1	17	36	65	50	21	23	3	4
A102	346	81	209	108	10	4	1	0	78	3	4	1			13	23	15	8	2	5
AVERAGE		81.2	208.5	102.2	8.9	2.5	1.0	0.0	84.5	1.2	1.4	2.1	6.8	7.9	19.3	20.7	11.8	10.9	1.8	4.5
STANDARD DEVIATION		9.5	68.9	38.8	3.0	1.0	0.4	0.0	41.9	1.3	1.2	2.9	5.8	9.1	15.1	10.3	4.6	6.4	0.7	0.5
NUMBER OF SAMPLES		13	13	13	13	13	13	13	13	13	13	13	10	11	13	13	13	13	13	13
MAXIMUM VALUE		92	323	204	14	4	2	0	159	5	4	12	17	36	65	50	21	23	3	5
MINIMUM VALUE		60	97	56	3	1	0	0	25	0	0	0	1	1	6	10	6	5	1	4

TABLE #3

JUNCTION TRIANGLE GAS CHROMATOGRAPHIC DATA FEB/86

ACQUIRED AT THE ERNEST SITE

SAMPLE I. D.	SAMPLE ENDTIME	AREA % IND PEAKS	THC	ALKANES	CYCLO-ALKANES	ALKENES	CYCLO-ALKENES	ALKYNES	AROMATICS	CHLORO ALKANES	CHLORO ALKENES	CHLORO AROMATICS	PROPANE	2-METHYL PROPANE	BUTANE	2-METHYL-BUTANE	PENTANE	TOLUENE/ E-BENZENE	BENZENE/ E-BENZENE	XYLENES/ E-BENZENE
A112	1135	62	332	134	9	2	1	0	174	2	2	2	8	18	14	16	10	4	0	3
A112	1229	62	275	105	7	3	1	0	139	2	3	2	15	12	20	19	11	4	0	4
A112	1326	89	201	70	5	1	1	0	101	2	3	1	17	6	16	14	6	4	0	4
A112	1425	60	278	63	8	1	1	0	177	2	0	2	26	4	12	11	7	1	0	3
A112	1530	90	312	61	11	3	1	0	220	2	0	2	15	4	11	11	7	9	0	3
A112	1900	83	139	56	6	2	1	0	73	1	0	1		3	11	12	7	5	1	4
A112	1959	87	188	63	8	2	1	0	110	2	0	1	2	3	10	12	8	7	1	4
A113	2059	88	146	52	6	2	1	0	83	1	0	1	2	3	10	10	6	5	1	3
A113	2257	85	149	53	5	1	1	0	70	1	0	1	19	4	11	10	6	5	1	4
A113	2355	89	73	8	2	1	0	0	61	1	0	1						4	0	3
A113	124	90	215	72	10	2	1	0	117	1	2	2	10	4	13	13	8	16	1	4
A113	219	85	114	53	8	1	1	0	48	1	2	1		1	5	9	5	7	2	4
A113	316	89	124	86	7	2	1	0	28	0	0	1		5	20	23	10	5	2	4
A113	416	81	109	48	19	2	2	0	32	0	5	1			1	3	3	7	2	4
A113	524	92	49	27	2	0	0	0	15	1	0	0	3	1	4	5	5	6	3	4
A113	630	90	59	33	1	0	0	0	16	0	0	0	3	2	7	7	4	4	3	5
A113	739	89	113	56	4	1	1	0	46	0	0	1	5	2	8	13	8	8	2	4
A122	942	80	208	99	7	3	1	0	64	0	2	2	30	6	19	18	11	7	2	4
A122	1144	81	99	40	2	1	0	0	26	0	0	0	30	3	10	8	5	8	4	4
A122	1248	81	70	33	2	0	0	0	19	0	0	0	16	3	8	7	4	9	4	4
A122	1356	49	599	441	3	2	0	0	32	0	0	0	112	400	11	9	5	8	2	4
A122	1501	56	407	281	2	1	0	0	40	0	0	0	83	247	9	7	4	9	3	4
A122	1604	92	1117	723	3	1	1	0	53	0	0	1	336	667	11	8	5	5	1	4
A122	1706	73	100	47	2	1	0	0	35	0	0	0	15	5	10	10	6	5	2	4
A122	1824	51	210	137	4	1	1	0	44	0	0	0	23	73	13	15	9	6	2	4
A122	1924	83	103	50	2	1	0	0	32	0	0	0	18	5	8	10	7	7	2	4
A122	2109	79	72	32	1	0	0	0	21	2	0	0	15	3	8	6	55	8	3	3
A122	2209	95	68	34	1	0	0	0	25	0	0	0	7	9	5	6	4	7	2	3
A122	2307	62	118	72	2	0	0	0	23	0	0	0	21	39	8	8	5	5	1	4
A122	1	49	196	123	1	0	0	0	19	0	0	0	52	92	9	7	4	5	3	4
A131	102	96	130	89	2	0	0	0	20	0	0	0	19	60	7	6	4	5	2	4
A131	159	39	127	69	1	0	0	0	17	0	0	0	40	44	3	5	3	6	2	4
A131	305	87	104	58	8	1	1	0	26	1	0	0	10	8	7	5	3	11	2	4
A131	401	87	64	35	1	0	0	0	15	0	0	0	13	5	13	7	4	6	3	4
A131	500	83	52	25	1	0	0	0	14	0	0	0	12	3	7	5	3	5	3	4
A131	555	96	369	249	1	0	0	0	13	0	0	0	105	328	7	5	3	5	4	4
A131	658	82	78	43	1	0	0	0	16	0	0	0	18	11	9	7	4	8	3	4
A131	823	83	174	76	6	2	1	0	75	8	2	1	3	2	7	13	9	7	3	3
A131	916	77	186	80	4	5	1	0	53	1	2	1	41	7	13	17	10	7	3	3
AVERAGE		80.1	193.0	99.4	4.5	1.2	0.5	0.0	56.2	0.8	0.6	0.6	33.3	53.8	10.1	9.9	7.4	6.4	1.7	4.0
STANDARD DEVIATION		13.2	187.5	128.1	3.8	1.1	0.5	0.0	49.9	1.4	1.2	0.7	38.9	130.9	4.2	4.5	9.2	2.4	1.2	0.8
NUMBER OF SAMPLES		39	39	39	39	39	39	39	39	39	39	39	34	37	38	38	38	39	39	39
MAXIMUM VALUE		96	1117	723	19	5	2	0	220	8	5	2	336	667	20	23	55	16	4	5
MINIMUM VALUE		49	49	8	1	0	0	0	13	0	0	0	2	3	4	3	3	1	0	3

TABLE #4

JUNCTION TRIANGLE GAS CHROMATOGRAPHIC DATA.....FEB/86

ACQUIRED AT THE ANTLER SITE

SAMPLE I. D.	SAMPLE ENDTIME	AREA % IND PEAKS	THC	ALKANES	CYCLO-ALKANES	ALKENES	CYCLO-ALKENES	ALKYNES	AROMATICS	CHLORO ALKANES	CHLORO ALKENES	CHLORO AROMATICS	PROPANE	2-METHYL PROPANE	BUTANE	2-METHYL-BUTANE	PENTANE	TOLUENE: E-BENZENE	BENZENE: E-BENZENE	XYLENES: E-BENZENE
A132	1216	82	63	31	2	0	1	0	29	0	0	0			2	3	2	5	2	4
A132	1311	75	84	47	3	0	0	0	24	1	0	1	10	4	10	9	5	4	3	4
A132	1416	76	87	46	3	0	0	0	25	1	2	1	11	4	10	9	5	4	3	4
A132	1526	72	126	68	4	0	0	0	35	1	2	1	17	5	15	14	8	4	2	4
A132	1626	79	90	49	3	0	0	0	27	1	0	1	11	4	11	10	6	4	2	4
A132	1717	81	100	58	3	1	0	0	27	1	0	1	11	4	12	12	7	4	2	4
A132	1811	79	149	92	4	0	1	0	39	1	0	1	12	6	20	21	11	4	2	4
A132	1911	79	187	122	7	2	1	0	48	1	0	1	6	6	26	29	17	4	2	4
A132	2005	81	98	51	2	0	0	0	34	0	0	1	11	4	12	11	6	5	2	4
A132	2209	83	96	51	2	1	0	0	31	0	0	1	11	6	14	10	6	5	2	4
A132	3	18	101	54	2	1	0	0	31	0	0	0	12	5	14	11	6	6	2	4
A132	103	71	62	34	1	0	0	0	15	0	0	0	11	3	9	7	4	5	3	4
A132	203	74	59	27	1	0	0	0	20	0	0	0	10	3	8	6	3	4	1	4
A132	303	80	64	32	1	0	0	0	17	0	0	0	14	3	10	7	4	4	2	4
A132	403	70	51	22	1	0	0	0	17	0	0	0	12	2	6	4	3	5	1	4
A132	505	91	81	34	3	1	0	0	18	0	0	0	6	5	15	12	8	5	2	4
A132	610	86	82	50	3	1	0	0	23	0	0	0	6	4	13	11	7	5	3	4
A132	711	82	89	49	3	0	0	0	21	0	0	0	17	4	12	9	6	5	3	4
A132	809	83	388	204	18	4	2	0	129	0	6	1	25	13	44	43	30	9	2	4
A132	902	88	199	96	7	2	1	0	83	0	0	1	9	6	18	20	12	4	1	3
A132	956	86	178	67	5	1	1	0	84	0	2	1	18	6	16	13	8	5	1	4
A132	1052	86	166	61	4	1	1	0	84	0	2	1	13	4	14	12	7	4	1	3
A132	1150	80	155	60	3	1	1	0	67	0	2	1	21	7	14	11	7	7	1	4
A132	1244	80	113	51	3	1	0	0	45	0	0	0	14	6	13	10	6	4	1	4
AVERAGE		77.6	119.6	61.5	3.7	0.7	0.4	0.0	40.5	0.3	0.7	0.6	12.5	5.0	14.1	12.7	7.7	4.8	1.9	3.9
STANDARD DEVIATION		13.5	69.9	37.0	3.4	0.9	0.6	0.0	28.0	0.5	1.4	0.5	4.5	2.1	7.8	8.3	5.6	1.2	0.7	0.3
NUMBER OF SAMPLES		24	24	24	24	24	24	24	24	24	24	24	23	23	24	24	24	24	24	24
MAXIMUM VALUE		91	388	204	18	4	2	0	129	1	6	1	25	13	44	43	30	9	3	4
MINIMUM VALUE		18	51	22	1	0	0	0	15	0	0	0	6	2	2	3	2	4	1	3

TABLE #5

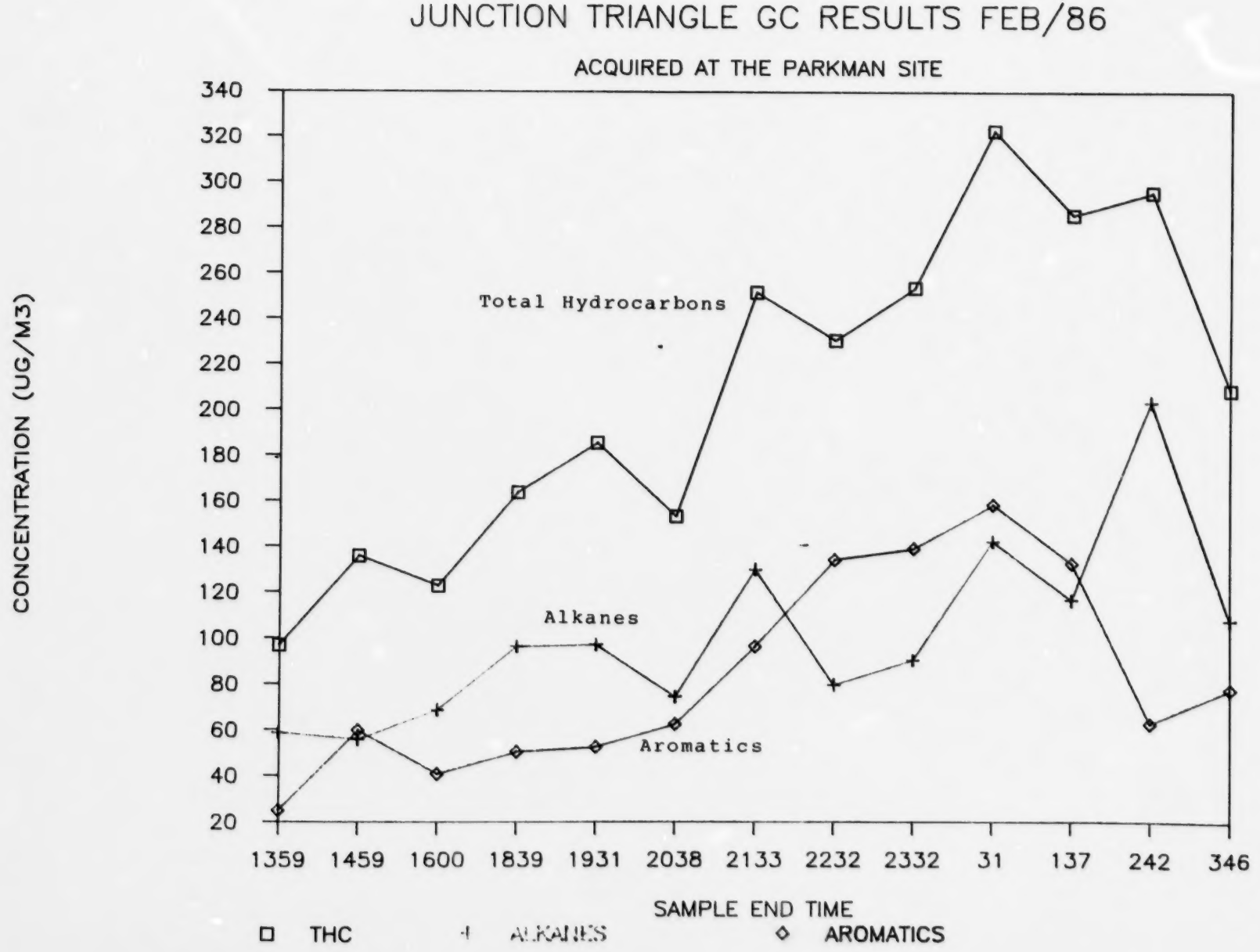
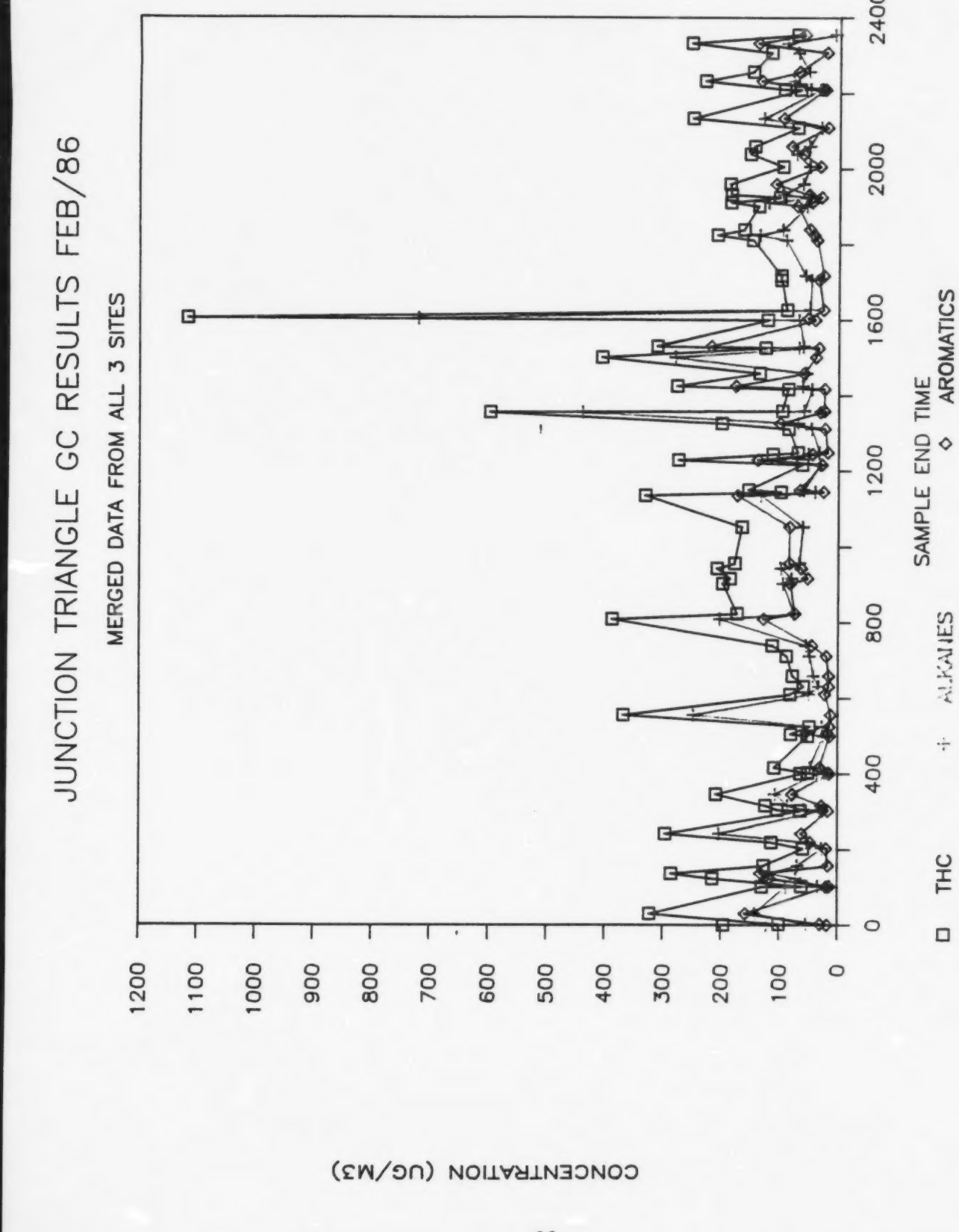

JUNCTION TRIANGLE GC RESULTS FEB/86
ACQUIRED AT THE PARKMAN SITE
CONCENTRATION (UG/M3)
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
Total Hydrocarbons
Alkanes
Aromatics
1359
1459
1600
1839
1931
2038
2133
2232
2332
31
137
242
346
SAMPLE END TIME
THC
ALKANES
AROMATICS

FIGURE #5

FIGURE #6


JUNCTION TRIANGLE GC RESULTS FEB/86
MERGED DATA FROM ALL 3 SITES
CONCENTRATION (UG/M3)
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
400
800
1200
1600
2000
2400
SAMPLE END TIME
THC
AROMATICS

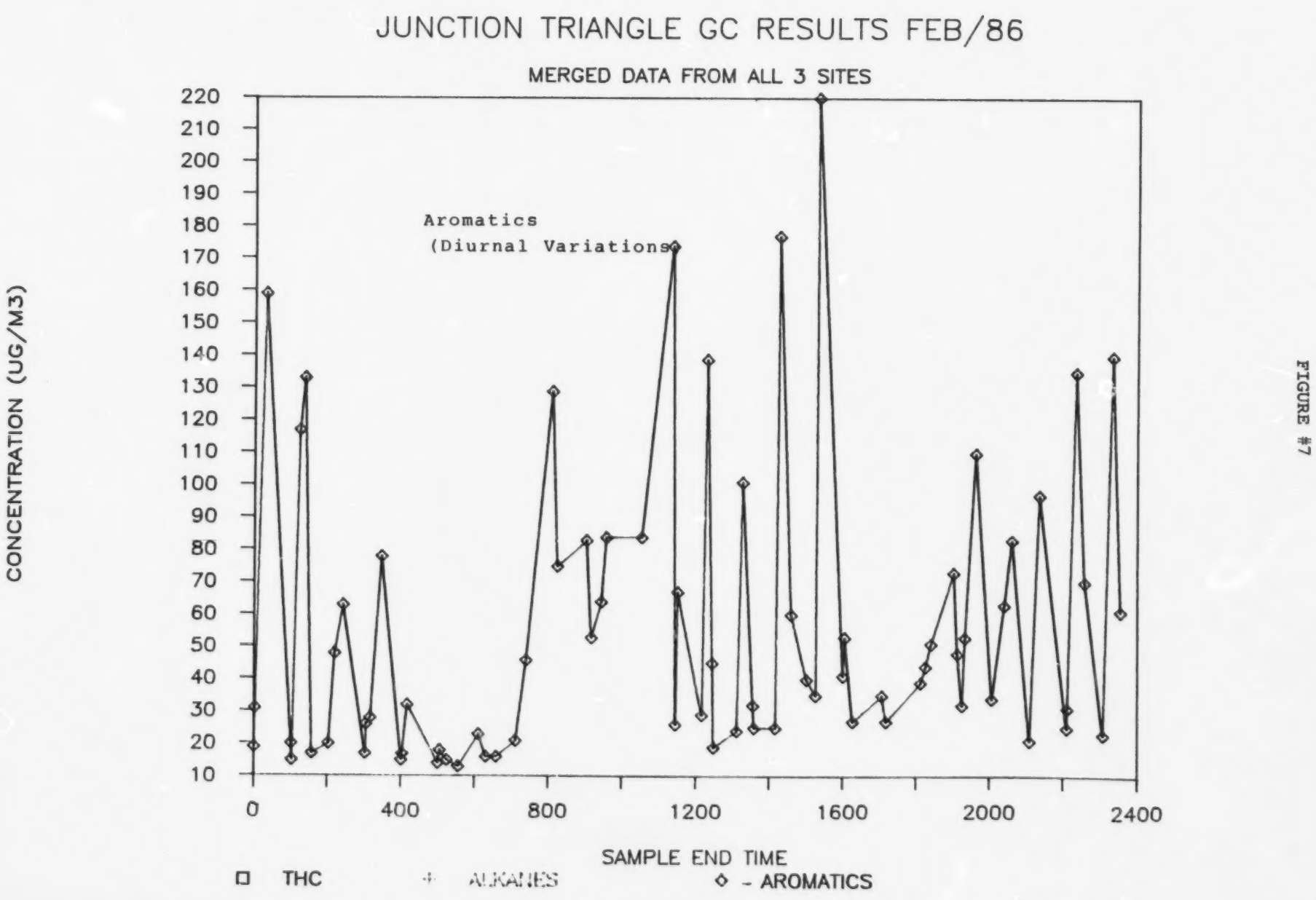

JUNCTION TRIANGLE GC RESULTS FEB/86
MERGED DATA FROM ALL 3 SITES
Aromatics
(Diurnal Variations
CONCENTRATION (UG/M3)
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
400
800
1200
1600
2000
2400
SAMPLE END TIME
□ THC
+ ALKANES
◇ - AROMATICS

FIGURE #7

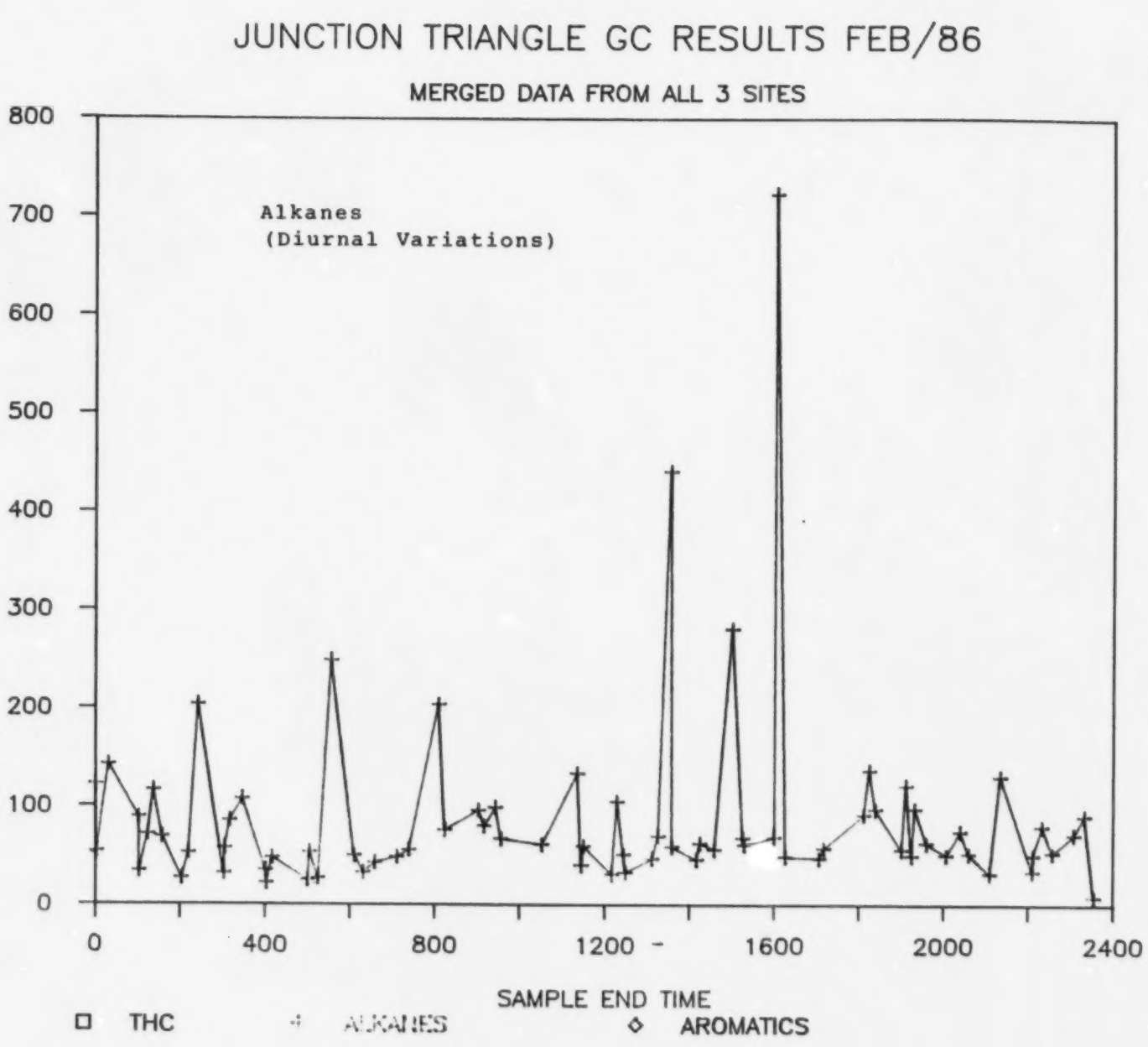

JUNCTION TRIANGLE GC RESULTS FEB/86
MERGED DATA FROM ALL 3 SITES
Alkanes
(Diurnal Variations)
CONCENTRATION (UG/M3)
800
700
600
500
400
300
200
100
0
0
400
800
1200
1600
2000
2400
SAMPLE END TIME
THC
ALKANES
AROMATICS

FIGURE #8

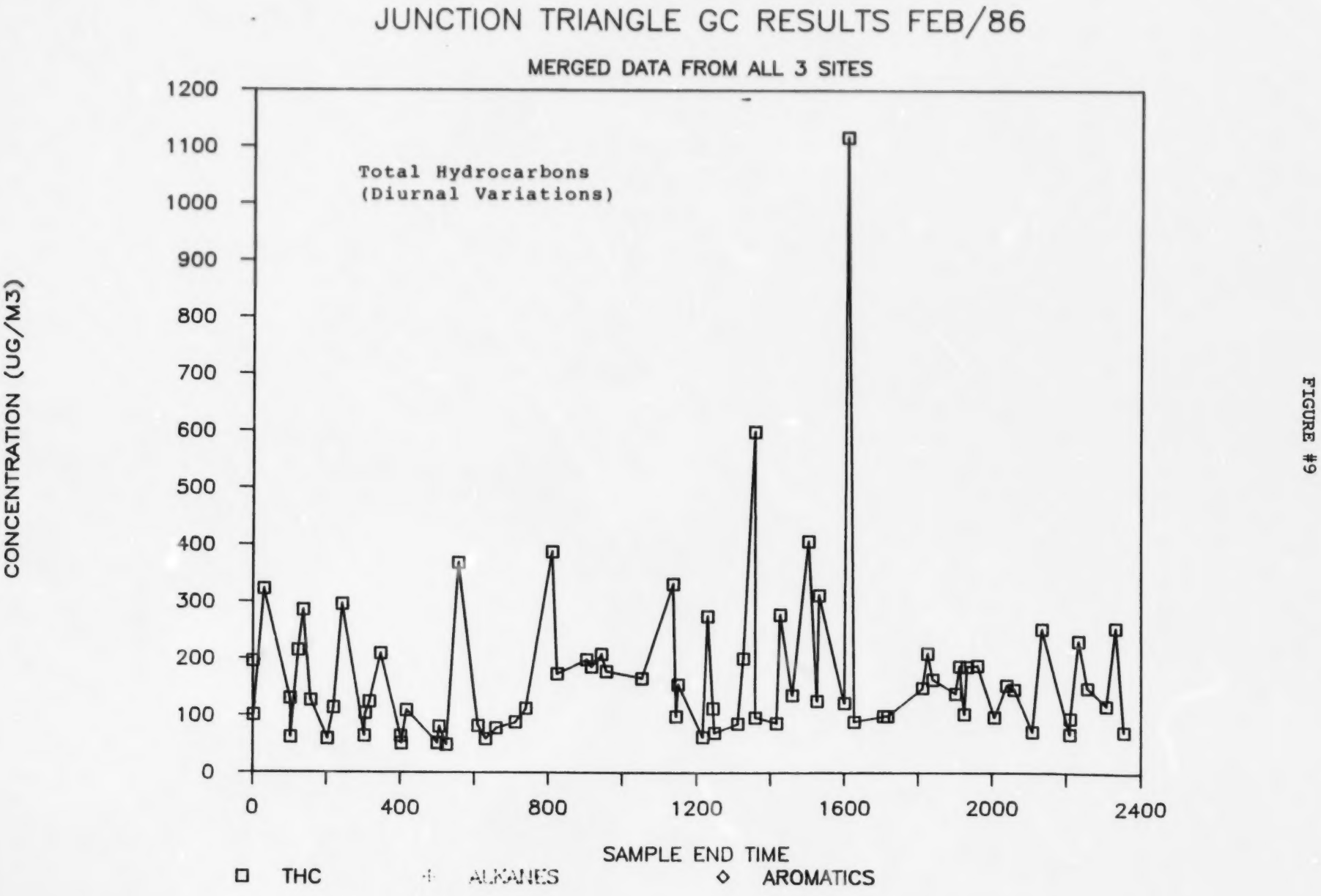

JUNCTION TRIANGLE GC RESULTS FEB/86
MERGED DATA FROM ALL 3 SITES
Total Hydrocarbons
(Diurnal Variations)
CONCENTRATION (UG/M3)
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
400
800
1200
1600
2000
2400
SAMPLE END TIME
THC
ALKANES
AROMATICS

FIGURE #9

JUN_TRI_86: A102

Start: 86/02/10 13:12 Scan: 60 sec. Ave: 30.0 min. Duration: 17.1 hrs.
Loc: Pole #5 on Parkman Avenue (north side of park)

WINDS Blowing Towards
1 Division = 10% of Time
Calm (< 3 km/hr) = 67.6%
Low (< 3 km/hr) = .0%
High (>100 km/hr) = .0%

Non-CH4 Blowing From
1 Division = 1 ppm -- A. MEAN

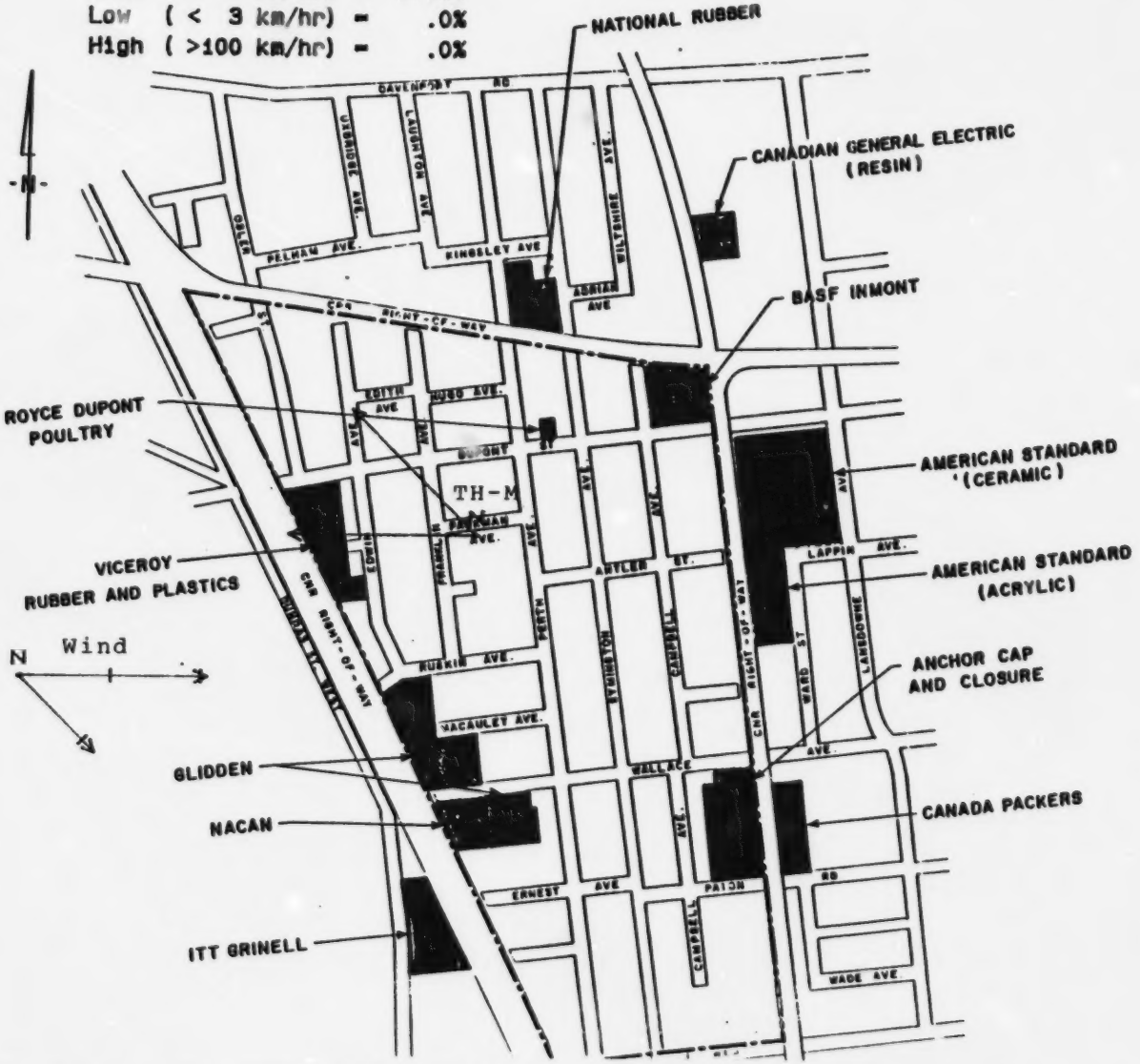


FIGURE #10

JUN_TRI_86: E001

Start: 86/02/11 10:09 Scan: 60 sec. Ave: 30.0 min. Duration: 47.7 hrs.
Loc: Merging of all data acquired on Ernest Avenue..just west of Perth

WINDS Blowing Towards
1 Division = 10% of Time
Calm (< 3 km/hr) = 12.6%
Low (< 3 km/hr) = .0%
High (>100 km/hr) = .0%

Non-CH4 Blowing From
1 Division = 1 ppm --- A. MEAN

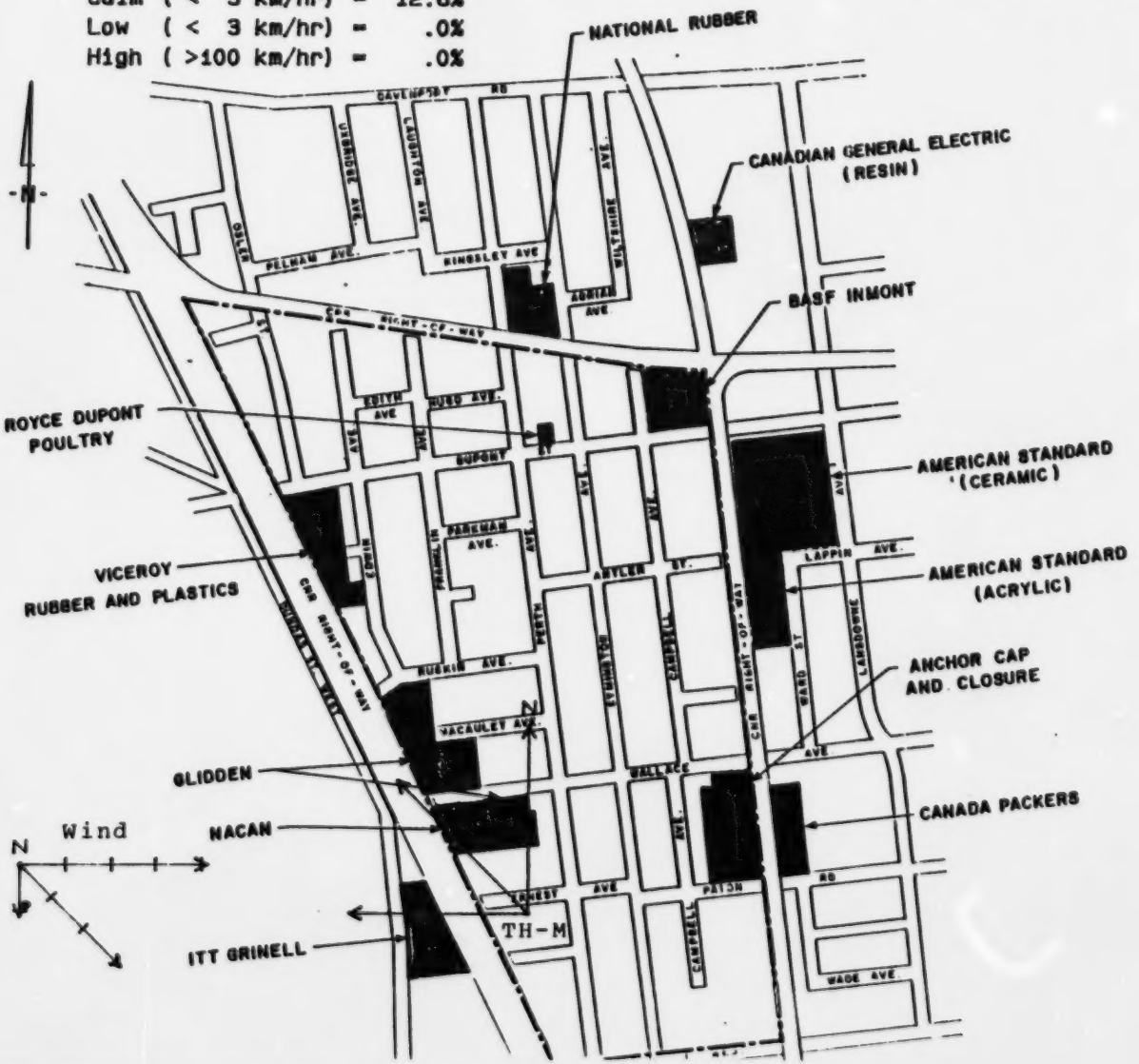


FIGURE #11

JUN_TRI_86: E001

Start: 86/02/11 10:09 Scan: 60 sec. Ave: 60.0 min. Duration: 47.7 hrs.
Loc: Merging of all data acquired on Ernest Avenue..just west of Perth

WINDS Blowing Towards
1 Division = 10% of Time
Calm (< 3 km/hr) = 12.8%
Low (< 3 km/hr) = .0%
High (>100 km/hr) = .0%

SO2 Blowing From
1 Division = .01 ppm — A. MEAN

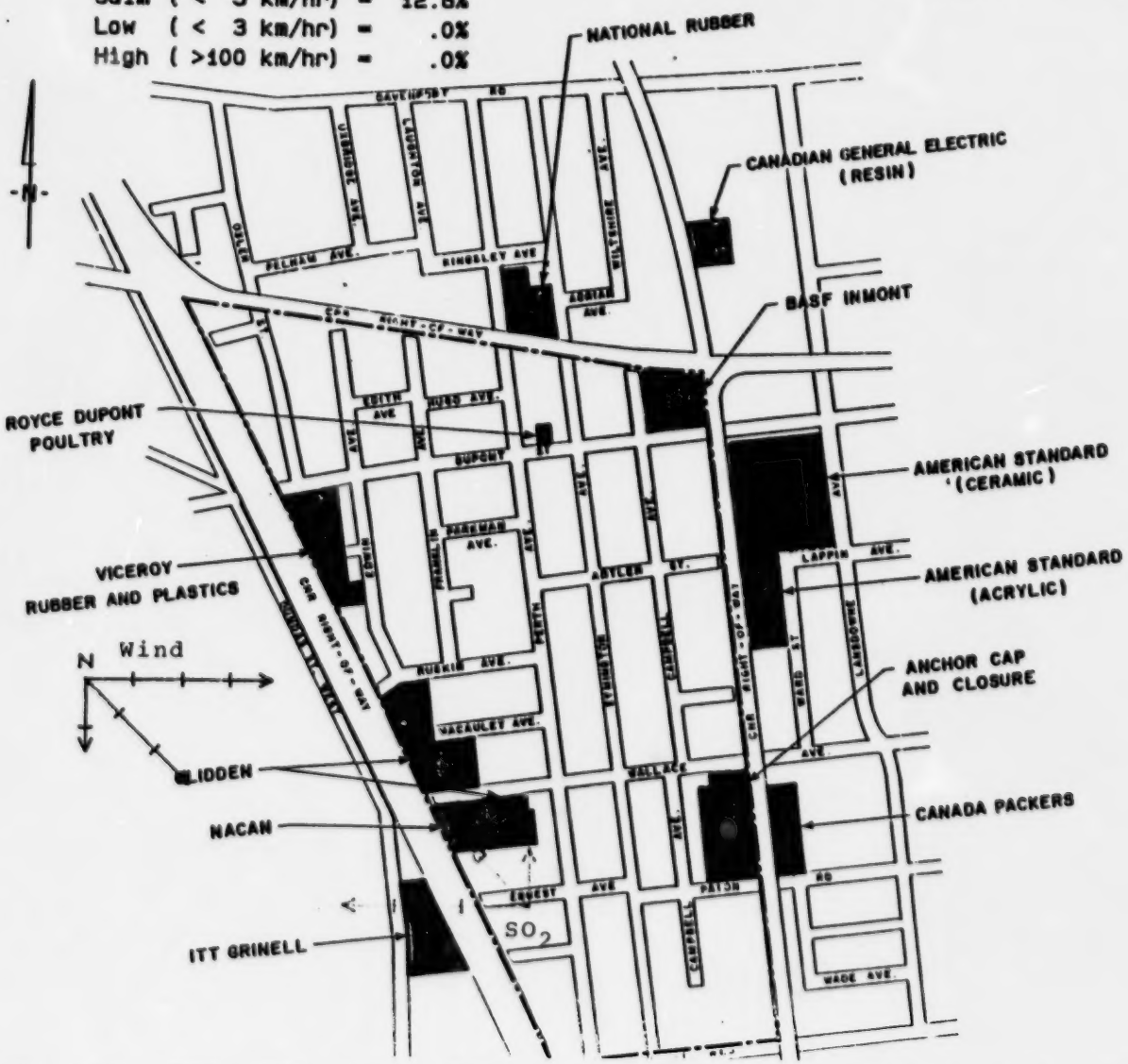


FIGURE #12

JUN_TRI_86: A132

Start: 86/02/13 11:06 Scan: 60 sec. Ave: 30.0 min. Duration: 26.1 hrs.
Loc: Pole #25 on Antler Street...at east end by railway tracks

WINDS Blowing Towards
1 Division = 10% of Time
Calm (< 3 km/hr) = .0%
Low (< 3 km/hr) = .0%
High (>100 km/hr) = .0%

Non-CH4 Blowing From
1 Division = 1 ppm — A. MEAN

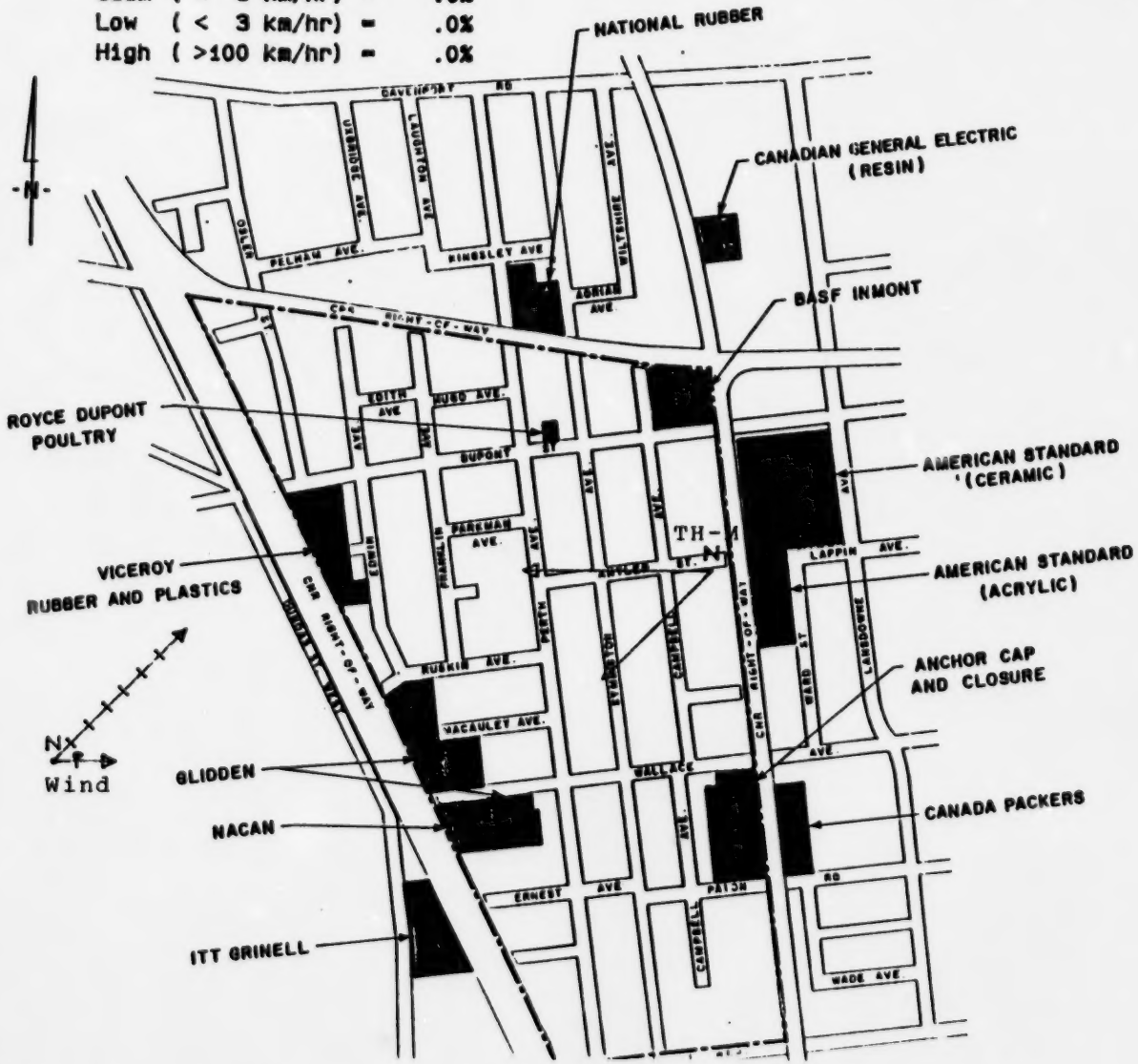


FIGURE #13

TABLE #6

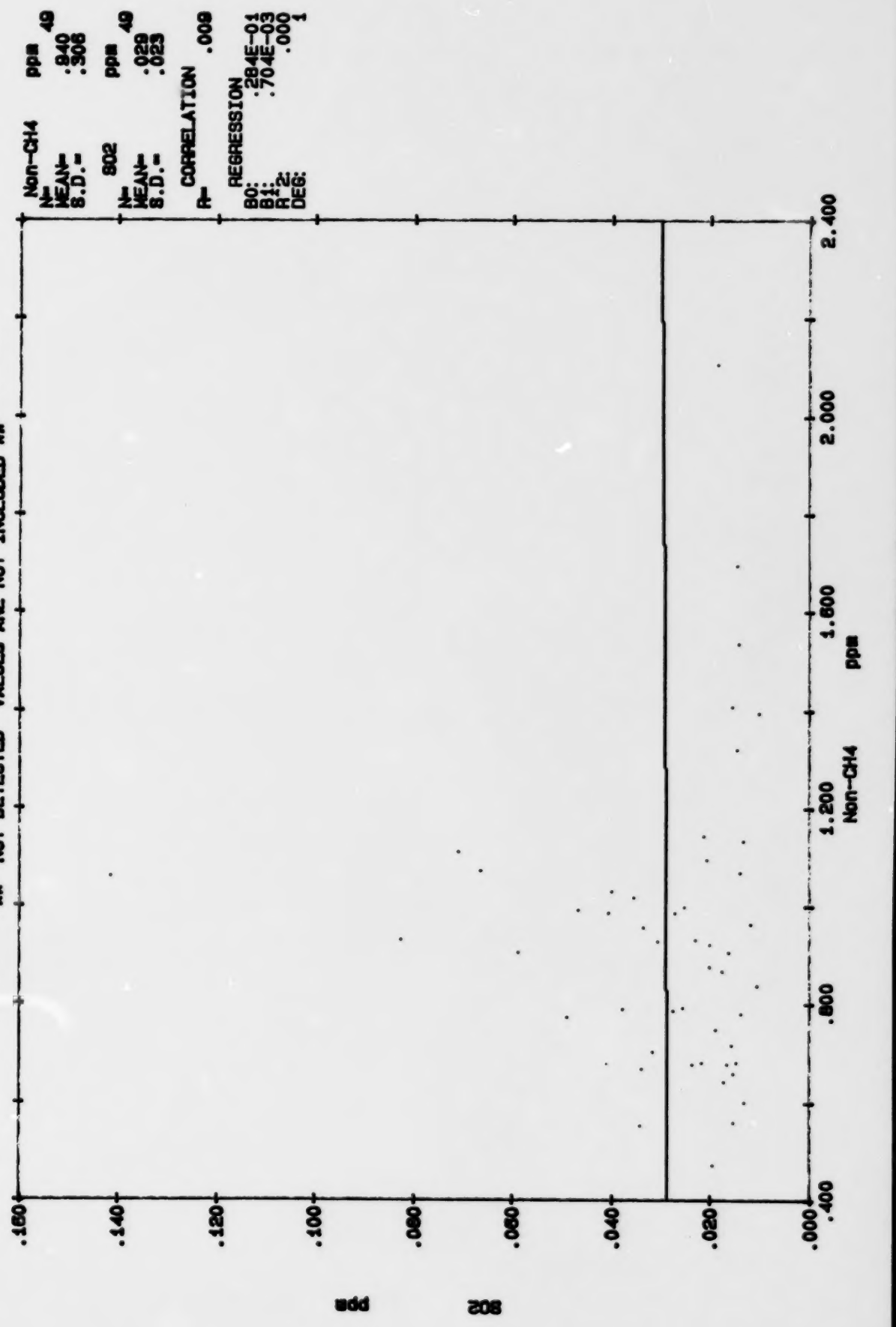
JUN_TRI_86 : M001

Start: 86/02/10 13:12 Scan: 60 sec
Average: 60.00 min Rnd Time: .00 min
Duration: 96.00 hrs No. Averages: 96
Loc: Merging of all data collected in Junction Triangle..02/86
% Valid Data Required: 95.0 %
Values < MDL are NOT Included
* = Corr. Signif. at 5.0 % Level, 2-Sided Test

--- CORRELATION COEFFICIENTS ---

	CO	SO2	Non-CH4	NOx	NO2	NO	Ozone	SolarRad	Temp
CO	1.000	.176	.474*	.548*	.377*	.443*	-.488*	-.093	-.137
SO2	.176	1.000	.009	.304	.323*	.162	.320	-.171	.110
Non-CH4	.474*	.009	1.000	.290*	.258*	.343*	-.130	-.039	-.321*
NOx	.548*	.304	.290*	1.000	.747*	.986*	-.427*	-.032	-.019
NO2	.377*	.323*	.258*	.747*	1.000	.680*	-.264*	-.428*	-.277*
NO	.443*	.162	.343*	.986*	.680*	1.000	-.420*	-.133	-.187
Ozone	-.488*	.320	-.130	-.427*	-.264*	-.420*	1.000	.246*	.365*
SolarRad	-.093	-.171	-.039	-.032	-.428*	-.133	.246*	1.000	.696*
Temp	-.137	.110	-.321*	-.019	-.277*	-.187	.365*	.696*	1.000

FIGURE #14


JUN_TRI_86: M001
SO2 vs. Non-CH4
START: 86/02/10 13:12:00 SCAN: 60 sec AVE: 60.0 min
LOC: Merging of all data Collected in Junction Triangle..02/86
NOT DETECTED VALUES ARE NOT INCLUDED
Non-CH4 ppm 49
N=
MEAN= .840
S.D.= .308
SO2 ppm 49
N=
MEAN= .029
S.D.= .023
CORRELATION .009
R=
REGRESSION
B0: .284E-01
B1: .704E-03
R^2: .000
DE6: 1
.180
.140
.120
.100
.080
.060
.040
.020
.000
.400
.800
1.200
1.600
2.000
2.400
Non-CH4 ppm
SO2 ppm

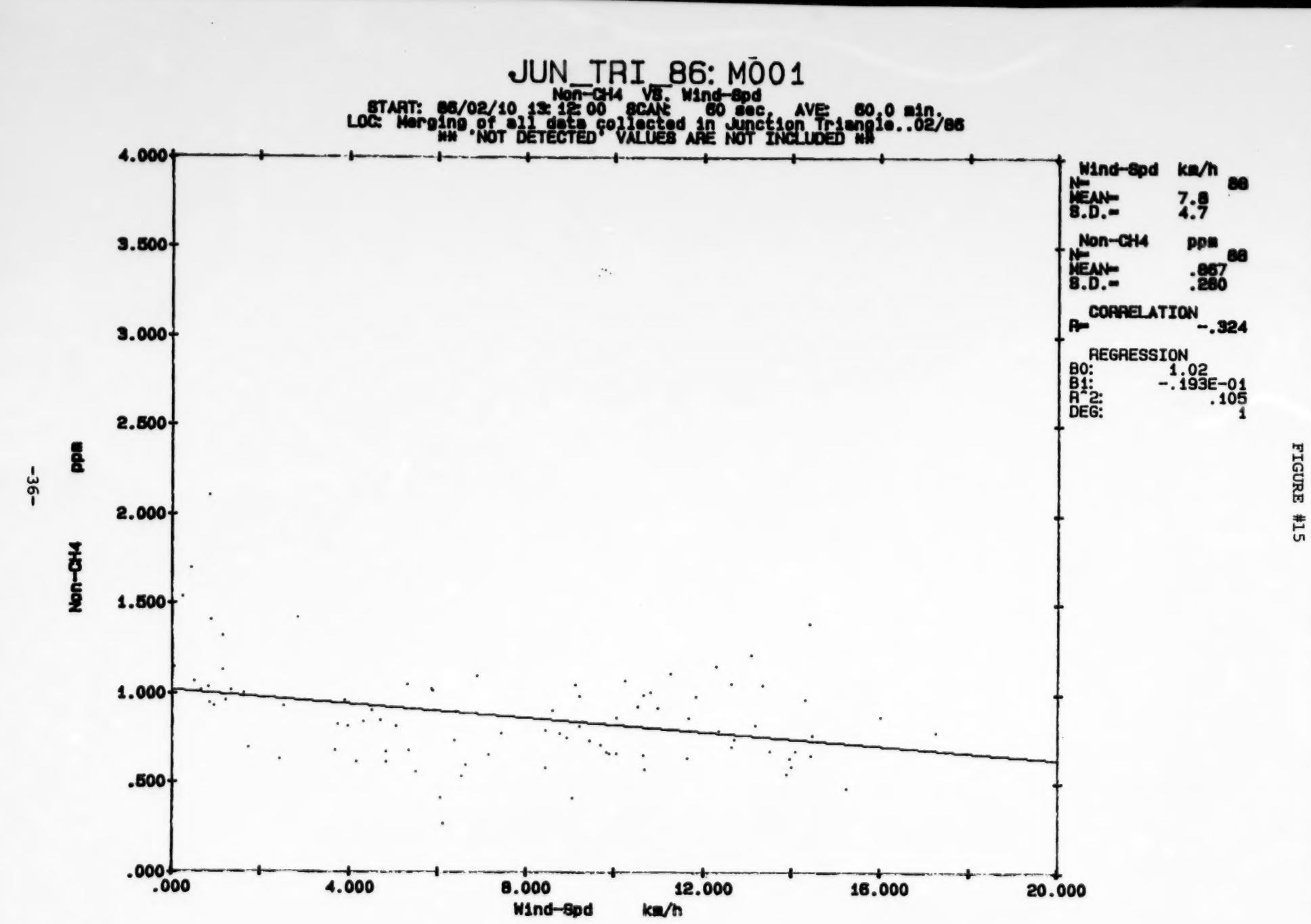

JUN_TRI_86: M001
Non-CH4 VS. Wind-Spd
START: 86/02/10 13: 12: 00 SCAN: 60 sec. AVE: 60.0 min.
LOC: Merging of all data collected in Junction Triangle..02/86
'NOT DETECTED' VALUES ARE NOT INCLUDED
Wind-Spd km/h
N= 88
MEAN= 7.8
S.D.= 4.7
Non-CH4 ppm
N= 88
MEAN= .867
S.D.= .280
CORRELATION
R= -.324
REGRESSION
B0: 1.02
B1: -.193E-01
R^2: .105
DEG: 1
Non-CH4 ppm
4.000
3.500
3.000
2.500
2.000
1.500
1.000
.500
.000
.000
4.000
8.000
12.000
16.000
20.000
Wind-Spd km/h

FIGURE #15